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(54) Integration of diagnostics and control in a component-based production line

(57) The invention relates to the integration of diagnostics and control in a production line based on process components (10). Preferably, the control system and the diagnostic system are built as a hierarchical and highly distributed system, where as much as possible of the pre-processing and low-level diagnostics is accomplished at the lower levels of the system. At the process component level, diagnostics (12) are integrated with the control software (11) controlling the process hard-

ware of the production line. The production line is typically comprised of a number of cells of process components, and each cell is controlled by a cell controller (20). At the cell level, diagnostics (22) are integrated in the cell control software (21) of the cell controllers (20). For example, diagnostic functions could be integrated with the control software programs by extending the IEC 1131-3 SFC language with diagnostic functions, or pre-compiling the source code of the control program and adding code for diagnostic functions.

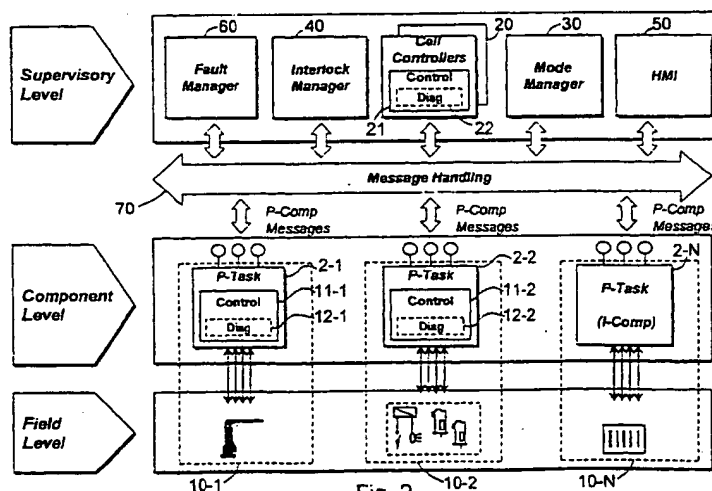


Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 3127

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D, Y	V DUGERN O ET AL: "EINE MODULARE GRUNDSTEUERUNG FUR FLEXIBLE MONTAGEZELLEN" AUTOMATISIERUNGSTECHNISCHE PRAXIS - ATP, DE, OLDENBOURG VERLAG. MUNCHEN, vol. 32, no. 1, 1 January 1990 (1990-01-01), pages 22-29, XP000126014 ISSN: 0178-2320 * page 25, left-hand column, paragraph 6 - page 27, left-hand column, paragraph 2 *	1-3, 14, 17, 20-22, 35	G05B19/418
A	---	4-19, 23-34	
Y	ZAMA E ET AL: "An architecture for control and monitoring of discrete events systems" COMPUTERS IN INDUSTRY, NL, ELSEVIER SCIENCE PUBLISHERS. AMSTERDAM, vol. 36, no. 1-2, 30 April 1998 (1998-04-30), pages 95-100, XP004123797 ISSN: 0166-3615 * page 95, right-hand column, last paragraph - page 97, left-hand column, paragraph 1; figures 1, 2 *	1, 20-22, 35	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	---	2-19, 23-34	G05B
Y	GB 2 149 551 A (BRITISH HOVERCRAFT CORP LTD) 12 June 1985 (1985-06-12) * page 2, line 70 - page 5, line 34; figures 1-5 *	2, 3, 14, 17	
A	-----	4-13, 15, 16, 18-34	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 June 2000	Examiner Nettesheim, J
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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LACK OF UNITY OF INVENTION
SHEET B

Application Number

EP 99 20 3127

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-35

A diagnostic system in a discrete production line comprising a hierarchical system of components and a method for the engineering of the same

2. Claims: 36-40

First method for integrating diagnostic functions with control software controlling process hardware in a production line

3. Claims: 41-43

Second method (different from the first one in claim 36-40) for integrating diagnostic functions with control software controlling process hardware in a production line

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